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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/581,916

06/07/2006

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EXAMINER

BEHM, HARRY RAYMOND

ART UNIT

PAPER NUMBER

2838

MAIL DATE

DELIVERY MODE

06/19/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/581,916

Applicant(s)

EGUCHI ET AL.

Examiner

Harry Behm

Art Unit

2838

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 June 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 June 2006 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 6/7/06 and 9/8/06.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Drawings

Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: DC-DC converter with current sensing used to align the resonant current.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2 rejected under 35 U.S.C. 102(b) as being anticipated by Scheel (US 6,351,401).

With respect to Claim 1, Scheel discloses a DC-DC converter comprising: a transformer (Fig. 1 9) having primary [input] side terminals, secondary [output] side terminals, a primary side winding, and a secondary side winding and determining a voltage converting ratio $[N_s/N_p]$; a pair of switching means (Fig. 1 3,4 and 5,6) which is interposed between said primary side terminals and said primary side winding, a LC resonant circuit (Fig. 1 LC) comprised of a resonating reactor (Fig. 1 L) connected in series with said pair of switching means, and a resonating capacitor (Fig. 1 C) that resonates with said resonating reactor; and a driving means (Fig. 1 8) for alternately turning said pair of switching means ON/OFF, wherein: a resonant current detecting means (Fig. 1 12) for detecting a resonant current (Fig. 1 $i_{res}(t)$) caused by an operation of said LC resonant circuit and means for feeding a detected output (Fig. 1 $u_c(t)$) of said resonant current detecting means back to said driving means are provided; and said driving means drives (Fig. 1 a,b,c,d) said pair of switching means by correcting their on-state lapses of time so that their on-state resonant currents may be nearly equal to each other (Fig. 3 $i_{res}(t)$) based on the detected output of said resonant current detecting means.

With respect to Claim 2, Scheel discloses the DC-DC converter according to claim 1, wherein said resonant current detecting means (Fig. 1 12) is provided on the primary side of said transformer.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3-5 rejected under 35 U.S.C. 103(a) as being unpatentable over Scheel (US 6,351,401) in view of Sashida (US 5,189,603) and Hikari (JP 07039152).

With respect to Claim 3, Scheel discloses a bi-directional DC-DC converter comprising: a transformer (Fig. 1 9) having low-voltage side terminals (Fig. 1 U_{in}), high-voltage side terminals (Fig. 1 U_{out}), a low-voltage side winding [primary], and a high-voltage side winding [secondary] and determining a voltage converting ratio; a low-voltage side pair of switching means (Fig. 1 3,4 and 5,6) interposed between said low-voltage side terminals and said low-voltage side winding;

a low-voltage side rectifying element (Fig. 1 diodes 3-6) connected in parallel with each of switching elements (Fig. 1 3-6) in said low-voltage side pair of switching means;

and a driving means (Fig. 1 8) for turning ON/OFF the switching elements in said low-voltage side pair of switching means;

a resonant current detecting means (Fig. 1 12) for detecting a resonant current (Fig. 1 $i_{res}(t)$) caused by an operation of said LC resonant circuit and means for feeding a detected output (Fig. 1 $u_c(t)$) of said resonant current detecting means back to said driving means (Fig. 1 12) are provided;

and said driving means drives said low-voltage side pair of switching means (Fig. 1 a,b,c,d) or said high-voltage side pair of switching means by correcting their on-state lapses of time so that their on-state resonant currents (Fig. 3 1 $i_{res}(t)$) may be nearly

equal to each other based on the detected output of said resonant current detecting means.

Scheel discloses a passive output rectifier and does not disclose a high-voltage side pair of switching means interposed between said high-voltage side terminals and said high-voltage side winding.

Sashida teaches a DC-AC-DC-AC converter where the output rectifier is a high-voltage side pair of switching means (Fig. 2 15) interposed between said high-voltage side terminals (Fig. 2 153-154) and said high-voltage side winding;

a high-voltage side rectifying element (Fig. 2 D1-8) connected in parallel with each of switching elements (Fig. 1 S1A-S8A) in said high-voltage side pair of switching means.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use an active rectifier instead of a passive rectifier since it is well known the efficiency of a switch is superior to that of a diode.

Hikari teaches a converter wherein an LC resonant circuit (Fig. 1 K1) is interposed between said high-voltage side winding and said high-voltage side pair of switching means or between said low-voltage side winding and said low-voltage side pair of switching means.

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement the LC resonant circuit on the secondary side since it is known to implement the LC resonant circuit in the secondary.

With respect to Claim 4, Scheel in view of Sashida and Hikari discloses the DC-DC converter according to claim 3, wherein said LC resonant circuit is interposed between said high-voltage side winding and said high-voltage pair of switching means.

With respect to Claim 5, discloses the Scheel in view of Sashida and Hikari discloses the DC-DC converter according to claim 3, wherein said low-voltage side pair of switching means and said high-voltage pair of switching means are each configured by interconnecting four switching elements in a bridge.

Conclusion

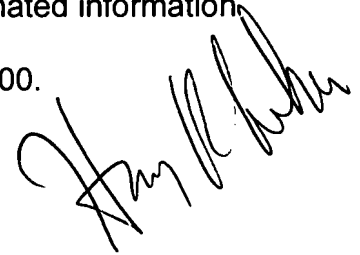
The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Loef (US 6,683,800), Matsunaga (US 6,130,831), Widener (US 5,057,698) and Sase (US 7,088,594) disclose bridge resonant converters with current sensing in the primary.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry Behm whose telephone number is 571-272-8929. The examiner can normally be reached on Business EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Karl Easthom can be reached on 571-272-1989. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

A handwritten signature in black ink, appearing to be "Amy R. Baker", written diagonally across the page.A handwritten signature in black ink, appearing to be "Karl Easthom", written above the printed name.

KARL EASTHOM
SUPERVISORY PATENT EXAMINER